There is another problem of no less consequence growing out of the same conditions, which will, with equal insistence, demand the attention of Prof. F. G. Cheshire and his colleagues. We have referred to the multiplicity of the varieties of optical glass to which the manufacturers of optical instruments are accustomed. This is, on the face of it, a great point in their favour; but when more narrowly considered it will be found to handicap them appreciably. Let the matter be considered from this point of view. A manufacturer develops by trial and error a very successful optical instrument—a field-glass, for example. He uses a particular combination of optical glasses in its construction. His whole design is built upon the special properties in respect of refraction and dispersion of these particular glasses. So long as he can procure a supply of them upon the open market he does not need to modify any feature of his manufacture. It is a question of repetition merely, and he closely guards the secret of his success. But the time may come when the particular variety of optical glass upon which he relies is no longer available, or not available in the required quantities. What can he do then? Speaking in general terms, he can then do nothing. The practical optician cannot tell him how to substitute staple glasses for the special varieties which he has been accustomed to employ, and hence he insistently demands the accustomed supplies. Thus the lavish variety of optical glasses available to the manufacturing industry has actually tended to restrict growth of output and to reduce adaptability.

Here is one of the practical questions awaiting solution by means of laboratory research. If the optical glass industry is to be well established in this country, it must be an industry which will satisfy the requirements of the manufacturing trade; if it is to be established with a minimum of effort, those requirements must be reduced to the narrowest limits which can suffice. To work out the principle of equivalence between varieties in the combination of glasses, and so to concentrate the glass-maker's labour, so far as is practically possible, upon the production of a few staple varieties, will be a very important object of practically applied research.

These instances may serve to illustrate some of the less generally recognised fields for the activity of the new department. We have not adverted to the more obviously important objects of training teachers, instructing workmen, educating experts, and advising manufacturers. These may be left to speak for themselves, since the limits of our space preclude any adequate exposition of them in the present article.

With one word of congratulation we may close, and that upon the choice of a director for the new undertaking. Prof. Cheshire brings to his task a mind not only well stored with the technical knowledge of his subject, but also instructed by a wide experience of its practical side. We have every confidence that in his hands the machinery of the new department at the Imperial College of Science and Technology will be directed to practically important ends, and while reserving our congratulation of him personally, upon the sound principle which forbids premature compliments to the warrior who is girding on his armour, we congratulate the authorities who, by their choice of him for the important post which he is about to fill, have shown how large practical considerations, such as those to which we have here adverted, bulk in their view. That, at least, is as it should be.

THE AEROPLANE BOMBER'S PROBLEM.

THE problem which the bomber on board an aeroplane has to solve is more difficult than the corresponding problem of the bomber on board an airship, since the aeroplane must move with respect to the air to support itself, while the airship may be brought to rest over the object to be bombed. The bomb on release has a horizontal speed equal to that of the aeroplane, and if the air were at rest and offered no resistance to the motion of the bomb through it, the path of the bomb would be a parabola with its axis vertical and its vertex at the point of release. The resistance of the air prolongs the time of fall of the bomb to an extent which depends on its size and weight, and may be 50 per cent. if the over-all density of the bomb is small. Any horizontal motion of the air causes a drift of the bomb down the wind which depends on the speeds of the various layers of air through which it passes during its fall, and on the resistance the air offers to the sideways motion of the bomb through it.

The dynamical equations which express the above facts have not yet been rigidly solved, but they are so closely related to the equations for high-angle fire in gunnery that the approximate methods of Col. Siacci or of Capt. Ingalls, or the recently published graphical method of Prof. Dalby, are all applicable, when the weight, altitude, and initial horizontal speed of the bomb, the mean speed and direction of the wind, and the resistances to downward and sideways motion of the bomb through the air are known. The altitude is shown on the aneroid of the aeroplane. The speeds of the aeroplane with respect to the ground and of the wind at the aeroplane are found by passing over an object with and against the wind respectively, and noting how long it takes the aeroplane to pass from the vertically overhead position to one, say, 10° or 20° up or down the wind from it. From the speed of the wind at the aeroplane thus found an estimate of the mean speed of the wind in the layers of air through which the bomb has to pass must be made, and this estimate can only be a rough one. With these data the bomber consults tables or curves previously prepared for the bombs to be used, which give him the bearing from the machine of the spot at which a bomb released at the moment should fall if the conditions remain unchanged. Thus the bombing aeroplane requires to be equipped with apparatus for measuring horizontal and vertical angles and times.

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The description in *La Nature* for June 16 of the equipment of one of the large German bombing aeroplanes made by the Gotha Wagonenfabrik and captured by the French in February shows that at that date these planes were only intended to drop bombs when moving with or against the wind, and not athwart it. The bomber sits in front of the pilot and is provided with a telescope about a metre long with a small magnification and a wide field of view. It is fixed in gimbals near his feet, and can be kept vertical by him with the help of a circular level, an image of the air-bubble of which is projected into the eyepiece. Below the objective an achromatic prism is placed with its refracting edge perpendicular to the axis of the telescope. By means of a graduated disc close to the eyepiece the prism can be rotated about a line perpendicular to the axis of the telescope, so that the line of sight of the telescope continues beneath the prism at any required angle up to about 30° with the axis of the telescope.

A stop-watch with its dial close to the eyepiece enables the preliminary speed observations to be readily made. The prism can then be clamped at the proper angle for the conditions found, and on looking down the telescope the bomber sees at each instant in the middle of the image of the air bubble and in the centre of his field of view the spot on which a bomb released at that instant would drop. If the aeroplane is moving directly towards a point in the air from which a given object can be bombed, the image of that object will move towards the centre of the field along a fore-and-aft line in the field. If the aeroplane is not moving directly towards the object, the observer has to rotate the telescope about a vertical axis to bring the object into the fore-and-aft line. The rotation of the instrument is recorded on a dial before the pilot, who alters the direction of flight until the observer can bring the telescope back to its normal position and the dial in front of the pilot shows no error of direction.

The instrument is made by the firm of Goerz, and there is no difficulty in modifying it so that the restriction of its use to flights with or against the wind no longer holds. Whether this has been found advisable may be doubted, in view of the uncertainty which always exists as to the character of the air movements between the aeroplane and the ground. C. H. Lees.

NOTES.

With reference to the paragraph which appeared in a recent issue of Nature regarding the Société de Chimie Industrielle, further particulars as to the scope of the new society appeared in *L'Echo du Commerce* for July 20. The object of the society will be to promote the science of chemistry as applied to industry. Local provincial branches will be formed which, while being self-governing, will keep in touch with the parent society at Paris. The society will institute research work with the view of assisting manufacturers and agriculturists. An institute and library are in contemplation which will contain a complete collection of French and foreign periodicals devoted to industrial chemistry, and the society hopes to arrange for meetings, exhibitions, etc., to stimulate activity. A review —the first number of which is expected to be published shortly—will keep manufacturers posted in the latest developments at home and abroad, describe inventions and processes, and, generally, fill a want that has been long felt in France. The first council of the society contains many names prominent in the scientific and industrial world.

For some days the firing in Flanders has been unusually heavy, culminating in the Allied attack on Tuesday, July 31. On Saturday last, July 28, according to a message from Amsterdam, the thunder of the guns reached a greater pitch of intensity than ever experienced previously. A similar remark is made by the Dover correspondent of the *Times* (July 30). The firing heard in that town was almost continuous throughout the night of July 28–29, and was particularly heavy about midnight and just before daybreak. A correspondent of the *Daily Telegraph* states that, on the afternoon of July 25, "while yet the hum of the London traffic was dominant, the sullen boom of the guns in Flanders was heard in many districts in South London. As the evening advanced the sound became a low growl, unmistakable, and practically continuous." The sound of the heavy firing on Tuesday was also heard distinctly in London.

The current *Quarterly Review* contains an article by Dr. C. Davison on his investigation of the sound-waves of the East London explosion of January 19 last. As stated in Nature for February 1 (p. 438), the sound-area consists of two detached portions. The inner sound-area is distorted in two main directions. Towards the east-south-east it reaches Canterbury, 48 miles, and to the north-west Wellingborough, 66½ miles; but to the north-east and south the boundary is only 19 or 20 miles from the source. The outer sound-area reaches from near Nottingham, across the south of Lincolnshire and Norfolk, to, and no doubt beyond, the east coast of the latter county. The most distant place at which the sound was certainly heard is Stow, near Lincoln, 128 miles. The width of the silent zone varies from 28 miles at the western and higher end to 48 miles at the eastern end. Speaking generally, the inner sound-area was one of single reports and the outer area one of multiple reports—two, three, and sometimes four reports being heard in quick succession. The existence of inaudible air-waves was manifested by the shaking of windows and the disturbance of pheasants, and the arrival of these waves was not, as a rule, coincident with that of the sound-waves. Within 15 or 20 miles of the source the air-waves passed after the sound was heard, at greater distances usually before. The air-waves were not, however, confined to the sound-areas, for their effects were noticed at sixteen places within the silent zone, nine of them being in the narrow western portion. The sound was heard at Ipswich, which lies a few miles from the northern boundary of the silent zone, and possibly also at Uppingham and Lilford, near the western end. It is inferred that both the inaudible air-waves and the sound-waves crossed the silent zone at moderate heights above the ground, but that the air-waves followed a lower path than the sound-waves.

Early in July Mr. Erik Andersson, of Uppsala, again led to Spitsbergen a geological expedition, which included Messrs. Adam Reuterskiöld, Sven Ydén, and Karl Samuelsson. The main object was to continue the investigation of the Trias and to collect saurians and fishes. The occurrence of phosphorite at Cape

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